The SDRPlay RSPduo SDR Receiver

Tim Kirby has had the new SDRPlay RSPduo Software Defined Receiver on his workbench, alongside the earlier RSPPro2 model. In his review, he evaluates this SDR receiver's main innovations and capabilities.

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It was with great interest that I heard the news of the release of the latest receivers from SDRPlay, the RSPPro2 and especially the RSPduo model (Fig 1).

I agreed when the editor asked me whether I would like to review them. I had heard good things about SDRPlay receivers in general but I had not tried one out for myself.

RSPduo Features

In **Table 1**, you will find a brief summary of the key features and benefits of the RSPduo, as described by the manufacturers, SDRPlay, in their product brochure.

If you wish to learn more about the technical design of the receiver, you can also look at its detailed specifications at this URL:
https://tinyurl.com/y8asncjf

While we are on the subject of web resources for the receiver, there is a very useful introductory document and video, which are well worth looking at before you get started with this receiver. Both of these can be found on the SDR website:
www.sdrplay.com/rspduo

Getting Started

The first thing to do was to download the SDRuno software package from the SDRPlay website and install it. This was painless enough and the installation went smoothly on a Windows 10 machine.

When new users acquire the SDRuno software, a hardware driver for the RSPduo is installed, as well as a new Windows service, which allows the RSPduo to communicate with the software.

I also downloaded the SDRPlay version of the DUMP1090 software to be used to receive ADS-B transmissions from aircraft.

To connect the RSPduo to the computer, you will need your own USB cable, which has a standard USB plug at one end and a Type-B connection at the other, plugging into the RSPduo.

You are offered a choice of aerial input connections on the RSPduo (Fig. 1).

Tuner 1 has a high-impedance input, allowing the connection of 1kΩ high-impedance balanced/unbalanced input, with convenient screw connectors.

The same *Tuner 1* input also provides for a 50Ω input (the default) terminated on an SMA-female connector. I grabbed a SMA (male) to SO239 adapter cable and connected a roof-mounted VHF/UHF vertical.

My first test was to receive a few FM broadcast stations in Band 2. This worked well; it was nice to see the RDS decoding information available – useful at this time of year, with significant Sporadic-E propagation happening.

Later, I ventured into airband, tuning the receiver to 133.600MHz, London ATC in the Brecon sector. This is some 90 miles or so from my location in West Oxfordshire and signals were coming in very well.

As ever, the panoramic display of an SDR is really useful because you identify 'spikes' in the spectrum view and discover frequencies you did not previously know about.

I was curious to see how the receiver performed on the amateur bands, so I tuned to 144.430MHz, the GB3VHF beacon in Kent (Fig. 2). The alternating Morse code and data signals were coming in at about the same strength as I would expect on my other amateur bands equipment.

On 50MHz, the GB3BAA beacon at Tring, on 50.016MHz, was easily audible.

I also had an interesting 'view' of the 70cm amateur band. The GB3UHF beacon on 432.430MHz (Fig. 2) showed a steady signal towards the lower end of the band and various repeaters were keying up and down around 433MHz. Moving towards the top end of the 433MHz segment, I saw lots of transmissions in the licence-free band, with weather stations and other devices all transmitting data.

On DAB, I received my local DAB Multiplex on **225MHz**, as shown in **Fig. 3**.

The Dual Tuners Feature

While this proved that the RSPduo was doing a good job, in terms of sensitivity across the VHF/UHF bands, I had not, so far, tried the two independent tuners. For this purpose, I connected a small aerial, sat on my first floor windowsill, for the 1090MHz band to the SMA connector for Tuner 2. I shut down SDRuno and navigated to the folder on my computer where I had installed the DUMP1090 software. By default, this will be at:

c:\program files (x86)\sdrplay\dump 1090

I double-clicked on the *start2i.cmd* file to start ADS-B reception in 2MHz interactive mode. A black console window appeared on the screen, which quickly filled with ADS-B messages. The *DUMP1090* software has a built-in web server. Point your web browser on the machine you are using to the following URL:
http://localhost:8080

If you do, you will see a map with aircraft displayed on it, showing their position, as well as speed, heading and diverse information about the aircraft itself.

I was pleased to note that I was receiving ADS-B signals from planes far out over the English Channel. This was equal to what I achieve with a dedicated ADS-B receiver here and it was better than the reception results, which can be attained with one of the RTL-SDR dongles.

With ADS-B reception running in the background, I started up the SDRuno software and was able to listen to the VHF airband at the same time. In many cases, this meant I was hearing transmissions from the aircraft the positions of which I could see on the map.

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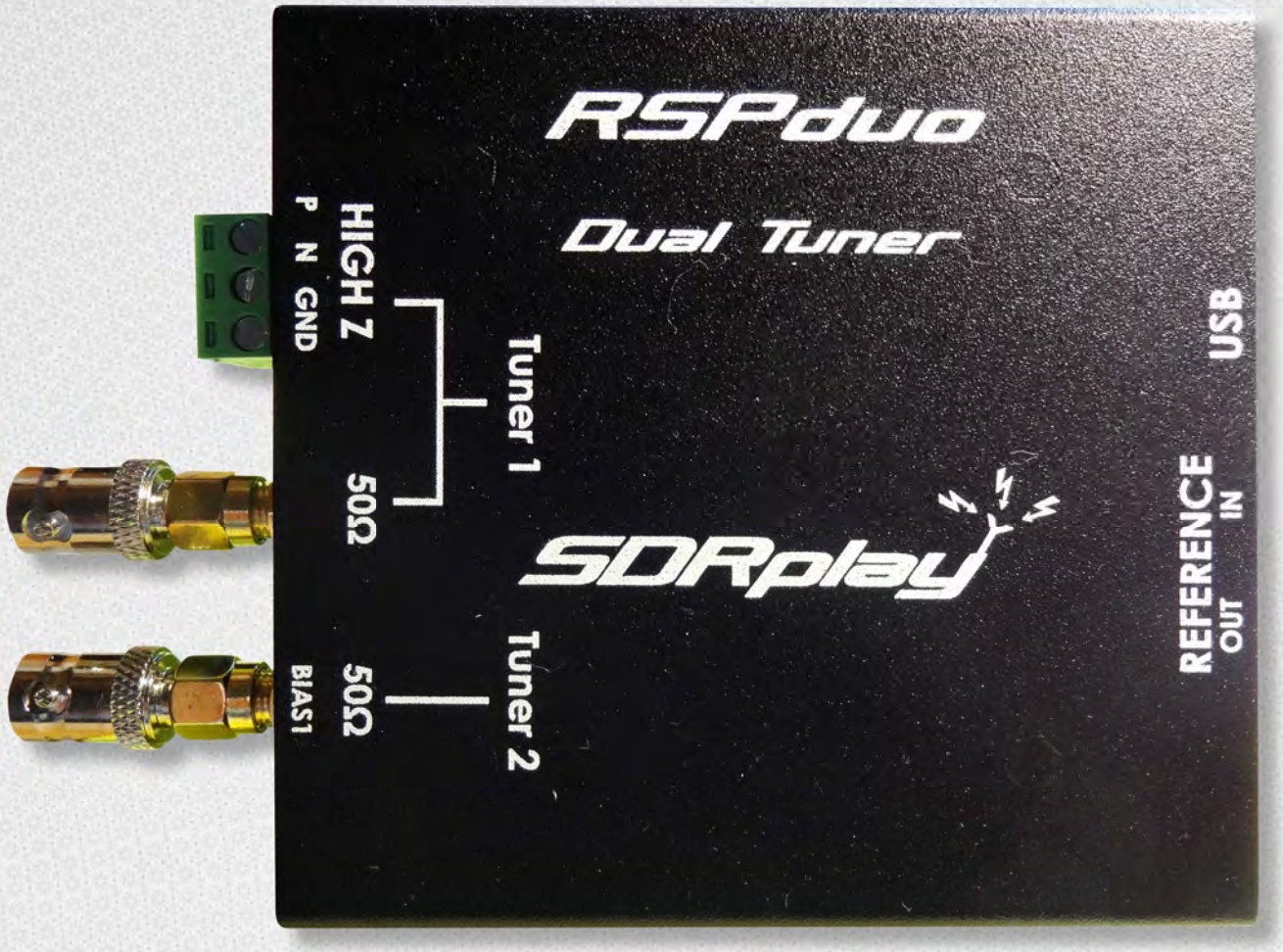

Fig. 1: The SDRPlay RSPduo SDR receiver and choice of aerial inputs.

HF Performance

Following a quick swap of the VHF/UHF vertical aerial on *Tuner 1* to a makeshift HF end-fed aerial, I thought I would try some broadcast band listening, all the while with the ADS-B decoding going on.

My first foray was in the evening around the 9MHz band. One of the more interesting stations received was Radio Free Asia from Taipei on 9355kHz. I also listened to Radio Romania International on 9500.5kHz (Fig. 4).

With regard to broadcast stations, I enjoyed getting used to the filtering available, narrowing down the bandwidth to eliminate interference and opening the filters up a bit wider when there was a strong signal.

With my rough-and-ready aerial, I found many interesting broadcast stations to listen to in the evenings around the 9, 11 and 15MHz bands.

Of course, I couldn't resist a quick foray into the 7MHz amateur band. Despite the poor aerial, I was able to hear many European stations coming through in Morse code. I decoded the Morse code by ear but one of the nice things that you can do with the SDRuno software is to use a Virtual Audio Cable (downloadable for free) to pipe the audio output into a decoding program.

In the case of Morse code, you might try the Fast Light Digital Modem application (Fldigi).

www.w1hkj.com

More Possibilities

I still had the second tuner running on ADS-B. However, there are plenty of other things you can try.

For example, Clint Gouveia used the two tuners on his RSPduo tuned to the same frequency to compare different aerials. This can be very interesting indeed and allows you to see, for instance, the difference that the height and position of an aerial can make to the reception quality at different times of the day.

Moreover, I thought it would be interesting to attempt some HF performance of the receiver, with just a simple piece of wire, about 20m long, just draped down the garden. I surmised that this is the sort of thing a beginner might try. Within the SDRuno software, I switched to the High-Z input and connected the wire to the screw terminal. No ground, no tuner.

There were some loud broadcast band stations coming through of course. However, while I was looking around, I spotted some signals around 6600kHz. You will have guessed that I had spotted aircraft traffic, with strong signals from Shanwick Radio on 6547 and 6595kHz. It was interesting listening to both the controllers and to the weaker signals from aircraft, as they arranged their transits across the Atlantic.

Further south, I was able to receive the air traffic controllers from Santa Maria in the Azores on 8906kHz.

I should add that the same setup worked admirably on 198kHz long wave, for listening to *Test Match Special* on BBC Radio 4

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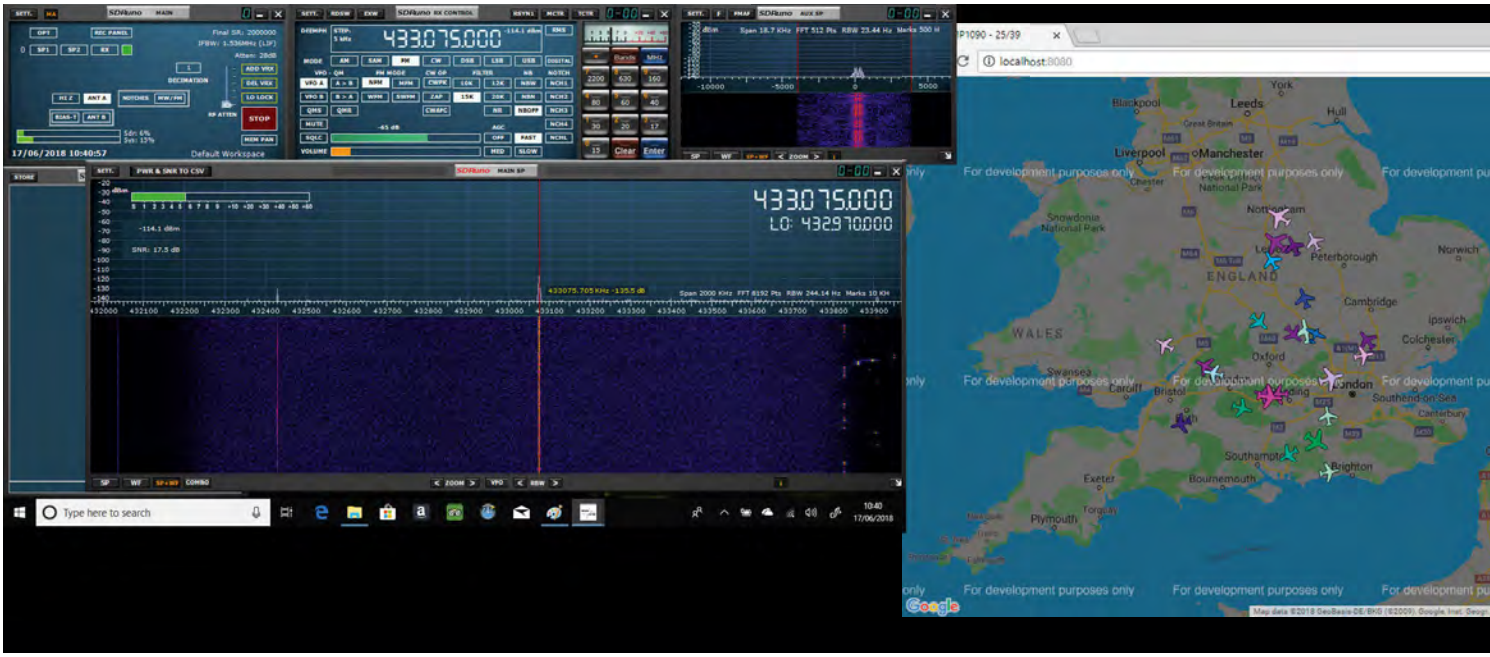

Fig. 2: The SDRuno software looking at the 70cm amateur band, with the GB3UHF beacon showing at 432.430MHz, a packet transmitter on 432.675MHz, the GB3BN repeater on 433MHz and activity in the 433MHz unlicensed devices band. All this while decoding ADS-B on 1090MHz.

and for some basic medium wave listening.

My impression was that the RSPduo worked well on medium wave and it would be interesting to put it to work for some medium wave DXing.

However, I did not have the opportunity to do that. It would be interesting too, to try the receivers down in the Very Low Frequency (VLF) band.

On the Microwaves

Up at microwaves, I connected the RSPduo to a PCB-type aerial (2-element HB9CV) for the amateur radio 23cm band. I listened for the GB3MHZ beacon in Suffolk on 1296.830MHz. Despite the aerial being inside and against the background of an obstructed path, I was thrilled to receive traces of the beacon over a distance of 160km or thereabouts.

I was slightly disappointed that – although the SDRuno software has the ability to save frequencies as memories – there is no ability to scan across banks of channels, as you might do on a scanning receiver.

This functionality would be really useful, especially at VHF/UHF.

However, SDRPlay informed me that this function is scheduled for the next release of the SDRuno software, which is imminent at the time of writing.

More Advanced Features

The RSPduo has some advanced features. In the preceding paragraphs, I have endeavoured to give you an idea of some of the things you can do with the receiver, rather than going into detail as regards all of the detailed technical features. That notwithstanding, I think it is worth highlighting some advanced facilities.

If you are operating in *Single-Tuner Mode*, you have the option to receive, monitor and record up to 10MHz of the spectrum. You can analyse this later, at your leisure.

I found this sort of feature absolutely invaluable after a CubeSat launch, deploying multiple satellites from the same launch vehicle. You can record a huge chunk of bandwidth across the UHF satellite spectrum, which you can then play back and analyse at your leisure, looking at and decoding the signals from the various satellites as they pass over your location.

You might well use the same feature in different ways, perhaps for listening to the LF spectrum at sunrise for that bit of Grey-Line DX. In *Dual-Tuner Mode*, you can have two slices of 2MHz spectrum – which is even more flexible. In my satellite scenario, you could, with a suitable aerial, monitor both VHF and UHF segments and record them for later analysis.

The tuners can be run in either Zero-IF or Low-IF mode. The default is Low-IF mode, which allows you to record 2 x 2Mb of bandwidth. You can only use Zero-IF mode to view 10MHz of spectrum and it is worth mentioning that Zero-IF mode is only available in *Single-Tuner Mode*.

You can only use the two tuners simultaneously if both are operating in Low-IF

- Simultaneous reception of two independent 2MHz spectrum windows, anywhere between 1kHz and 2GHz.
- Concurrent processing from 2 aerials, for direction-finding, diversity and noise reduction applications.
- Ideal for cross-band full-duplex reception, for example, HF + VHF or VHF + UHF.
- Simultaneous Dump1090 and VHF ATC reception or concurrent monitoring and recording of 2 ISM bands.
- Covers all frequencies from 1kHz through VLF, LF, MW, HF, VHF, UHF and L-band to 2GHz, without gaps.
- Receive, monitor and record up to 10MHz of spectrum at a time (Single-Tuner Mode).
- External clock input and output for synchronisation purposes or connection to a GPS reference clock.
- Excellent dynamic range for challenging reception conditions.
- Works with EXTIO-based SDR software (available in mid-2018).
- API provided, to allow demodulator or application development.
- Calibrated S meter/ RF power and SNR measurement with SDRuno (including data logging to .csv file).
- Dual-Tuner Mode provides independent coverage from 1kHz to 2GHz, using 2 aerial ports simultaneously.
- Up to 10MHz visible bandwidth (Single Tuner Mode) or 2 slices of 2MHz spectrum (Dual-Tuner Mode).
- Three software-selectable aerial ports (2 x 50Ω and 1 x 1kΩ high-impedance balanced/unbalanced input).
- High-impedance aerial port (1kHz to 30MHz); selectable MW notch filter and choice of two pre-selection filters.
- 14-bit ADC silicon technology.
- Software-selectable AM/FM/ DAB broadcast band notch filters for two SMA aerial (1kHz to 2GHz) ports.
- External clock input and output enables easy synchronisation to multiple RSPs or external reference clock.
- Powers over the USB cable with a simple type B socket.
- 11 high-selectivity, built-in, front-end preselection filters on both the 2 SMA aerial ports.
- Software-selectable multi-level low noise preamplifier.
- Bias-T power supply for powering aerial-mounted LNA.
- Enclosed in a rugged black painted steel case.
- SDRuno software for Windows.
- Documented API for new apps development.

Table 1: SDRPlay RSPduo: Key Features.

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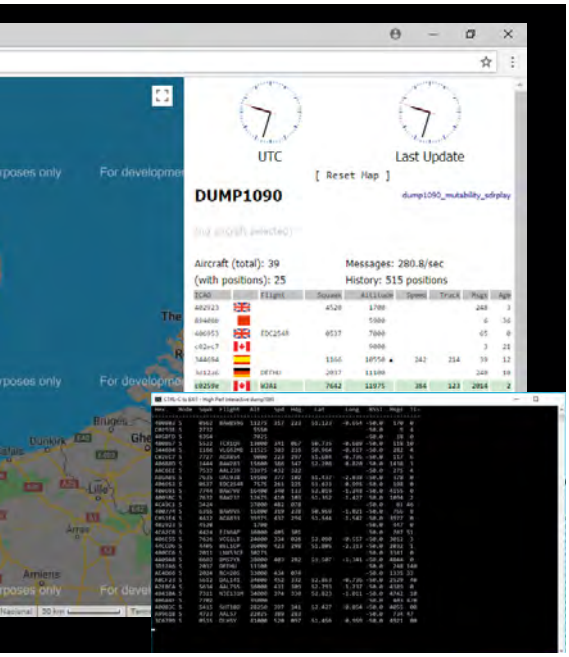

mode. In Low-IF mode, the maximum flat passband bandwidth of the IF filters is 1.536MHz, whereas in Zero-IF mode, it is possible to widen the filters to 8MHz.

For everyday use, I left this alone, but it is the sort of thing that you might explore as you become more experienced in using the receiver.

On *Tuner 2*, you can switch in a Bias-T to power an aerial-mounted preamplifier (supplying 4.7V at 100mA).

The RSPduo provides for an external clock input and output for synchronisation purposes or connection to a GPS reference clock, which may be used for frequency stability purposes.

The RSP2Pro

In this review, I have mainly covered the RSPduo. However, SDRPlay was kind enough to also supply me with the RSP2Pro SDR receiver model.

During the review period, I interchanged the RSPduo and the RSP2Pro and they were very similar, in terms of performance. The RSPPro2 is a slightly earlier evolution of the receiver. It is an RSP2 in a metal box, with enhanced antenna connectors and GPS reference capability.

The RSPduo, with its newer receiver design, should be superior. I think that in everyday use (I used both receivers across relatively 'extreme' situations) you won't notice a huge amount of difference, if any, between the two receivers. If you want the most up-to-date receiver design that SDRPlay can provide, then the RSPduo is the one for you.

The performance advantages of the RSPduo will most likely show up under the most challenging listening conditions, where the improvements in intermodulation performance and band pre-selection, along with 14-bit ADC resolution, will bring the greatest benefits.

For most users, the differentiator will be whether you want one or two tuners at the same time.

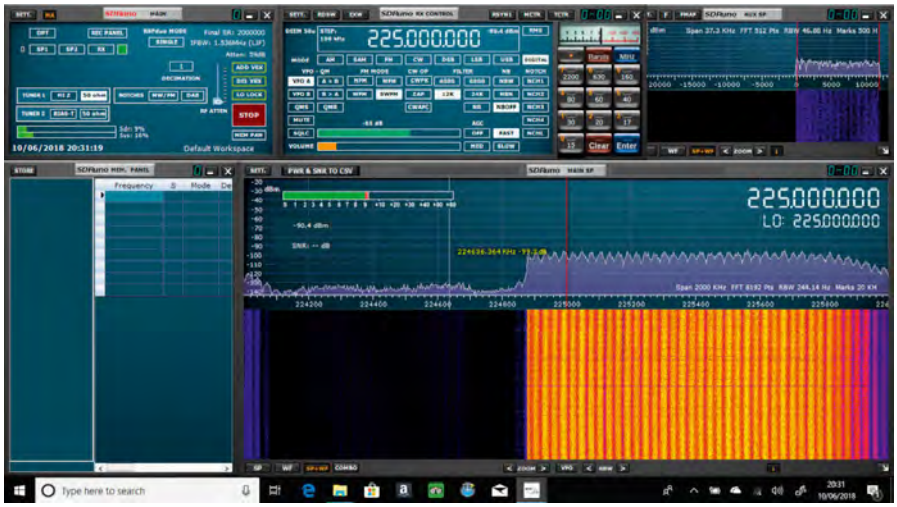

Fig. 3: My Local DAB Multiplex on 225MHz.

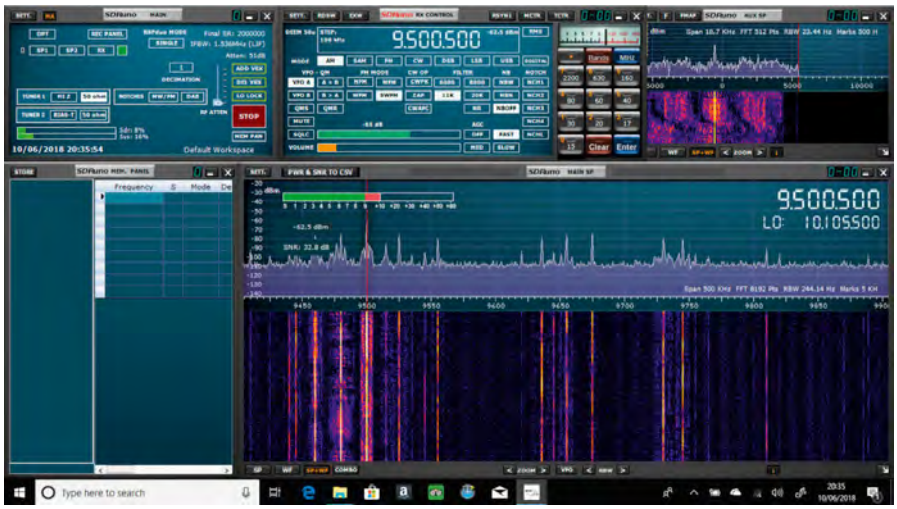

Fig.4: Receiving Radio Romania International on 9500.5kHz.

Conclusion

Using both the RSPduo and RSP2Pro was very enjoyable. I was amazed at what I was able to do with the receivers (especially on HF) with a reel of wire, one of the units and a computer!

At VHF/UHF and microwaves, with reasonable aerials, performance was everything you might hope for.

In terms of PC, you will need a relatively modern machine. However, I ran SDRuno successfully on a machine of more modest specifications (4GHz RAM and 2 x i3 cores) and I even had two instances of SDRuno running.

Make sure that your mouse has a wheel – it's really useful for fine tuning the receiver, especially on SSB.

I found the documentation for both the SDRuno and the DUMP1090 software very good. Although I was able to use both bits of software without the documentation, reading through it added to my knowledge and allowed me to pick up on some really useful features that I would otherwise have missed.

My warm thanks – and those of the editor – go to **Jon Hudson** and **Ian Harvey** of SDRPlay, for the generous loan of the receivers and for the prompt and enthusiastic responses to my questions from the SDRPlay Technical Support Team.

The RSPduo costs £240 including VAT and the RSP2Pro costs £192 including VAT.